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Handing of segregation populations: Back Cross Method

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Back Cross Method

Harlan and Pope (1922) suggested the back cross method by which an undesirable allele at a particular locus is replaced by the desirable allele in otherwise elite variety.

A cross between a hybrid (F₁ or a segregating generation) and one of its parents is known as **backcross**.

In the **Back Cross method**, the hybrid and the progenies in the subsequent generations are repeatedly back crossed to one of their parents.

Recipient parent: Well adapted, high yielding variety, lacking one or two characters and hence receives these genes from other variety.

Donor parent: The variety which donates one or two useful genes.

Recurrent parent: Since the recipient parent is repeatedly used in the backcross programme, it is also known as the recurrent parent.

Non-recurrent parent: The donor parent, on the other hand, is known as the non-recurrent parent because it is used only once in the breeding programme (for producing the F₁ hybrid).

Objective:

To improve or correct one or two specific defects of a high yielding variety, which is well adapted to the area and has other desirable characteristics.

Main Features of Back Cross method

1. Application
2. Parental Materials
3. Genetic Constitution
4. Number of Back Cross
5. Basic Requirements

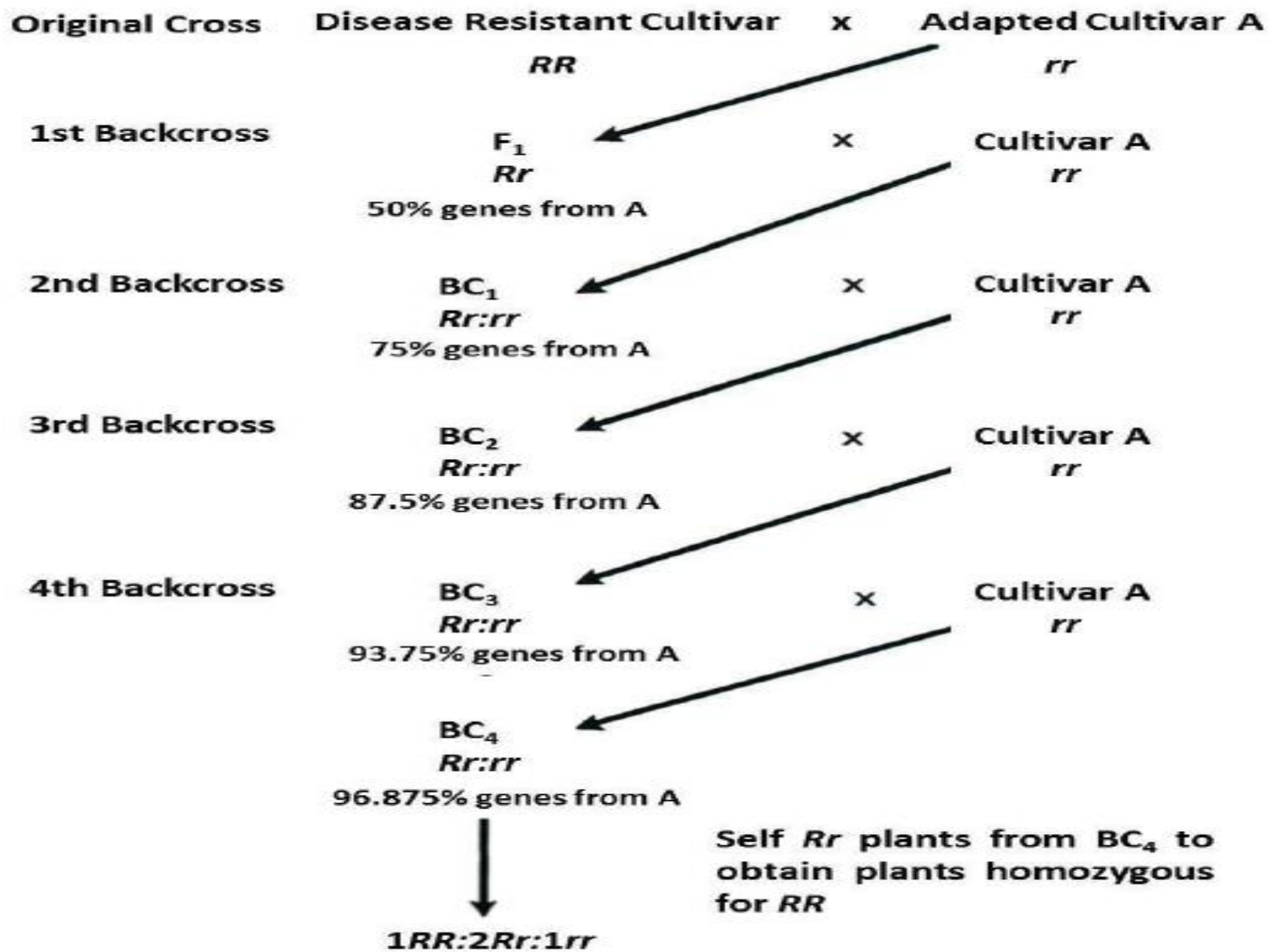
REQUIREMENTS OF A BACK CROSS PROGRAMME

1. Existence of a good **recurrent parent** variety which requires improvement is some qualitatively inherited character or a quantitative character with high heritability.
2. A suitable **donor parent** must be available possessing the character or characters to be transferred in a highly intense form.
3. **High expressivity of the character** under transfer through several back crosses in the genetic background of the recurrent parent.
4. The character to be transferred must have **high heritability** preferably determined by one or few genes.
5. **Simple testing technique** for detecting the presence of the character under transfer.
6. **Recovery of the recurrent genotype** in a reasonable number of back cross generations.

Applications of Back Cross method

- 1. Inter varietal transfer of simply inherited characters:**
characters governed by one or two major genes - E.g..
disease resistance, seed color, plant height etc.
- **Linkage drag:** Failure of transfer of simply inherited characters like disease resistance by B.C. method due to a tight linkage between the gene being transferred and some other undesirable gene.
- 2. Inter varietal transfer of Quantitative characters:**
Quantitative characters with high heritability can be transferred. E.g.. Earlyness, Pl. height seed size, seed shape.
- 3. Inter specific transfer of simply inherited characters:**
Mostly disease resistance from related species into a cultivated species. Eg. (i) Leaf and stem rust resistance from *Triticum timopheevii* *T. monococcum*, *Aegilops speltoides* and rye (*S. cereale*) to *T. aestivum* (ii) Black arm resistance from several *Gossypium* species to *G. hirsutum*.

- 4. Transfer of cytoplasm:** B. C. method used to transfer cytoplasm from one variety or species to another. This is especial desirable in cases of Cytoplasmic or Cytoplasmic-genetic male sterility. E. g. **Transfer of *T. timopheevii* cytoplasm to *T. aestivum*.**
- 5. Transgressive segregation:** Back cross method may be modified to obtain transgressive segregants.
- 6. Production of Isogenic lines:** Isogenic lines are identical in their genotype, except for one gene. Such lines are useful in studying the effects of individual genes on yield and other characteristics. Isogenic lines are easily produced using the back cross method.
- 7. Germplasm conversion:** Conversion of photosensitive germplasm lines (using as recurrent parent) to photo insensitive line (using a photo insensitive line as a donor or non-recurrent parent).



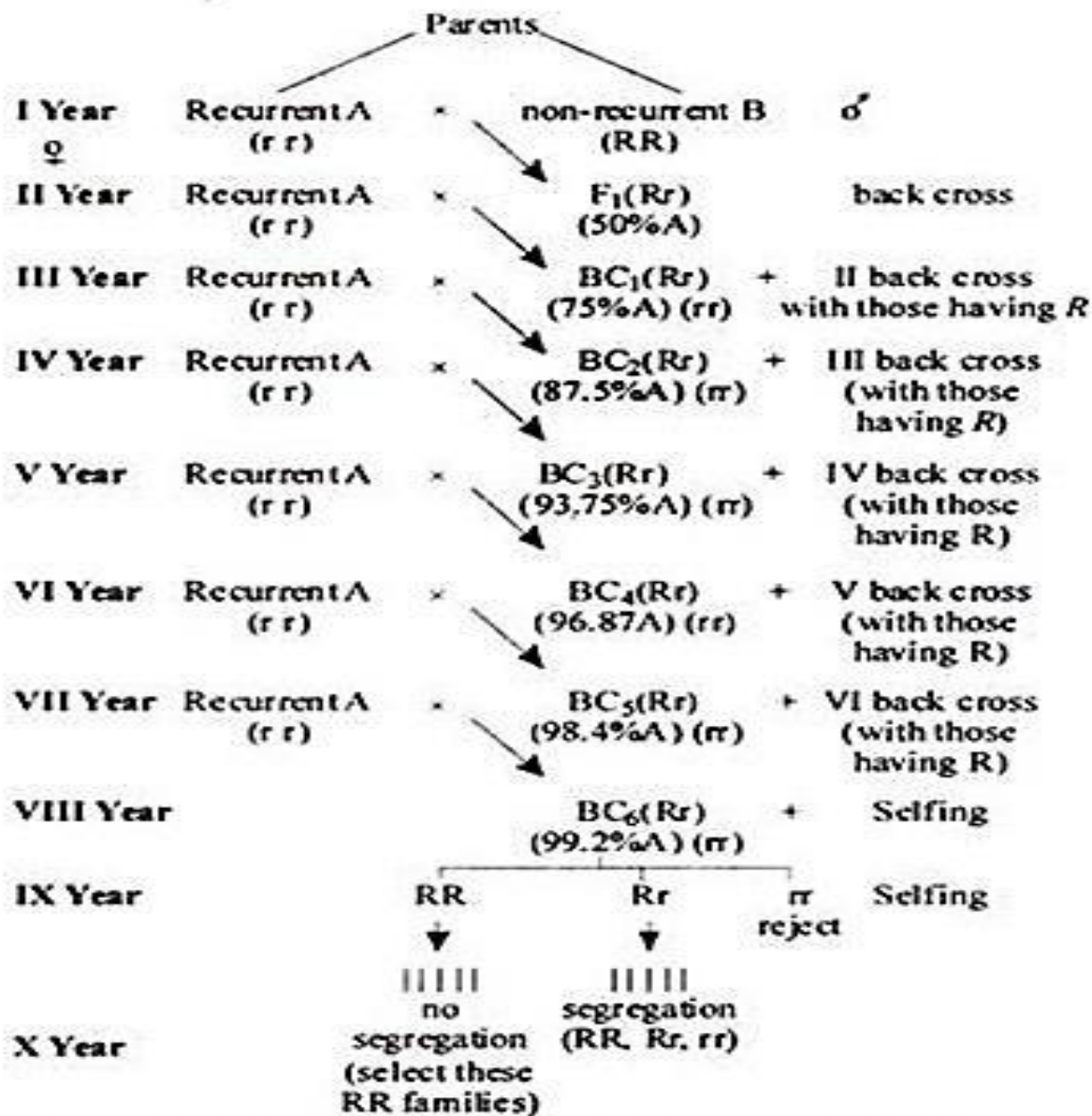


Fig. 12. Different steps involved in the back cross method of plant breeding in a self pollinated crop, when a dominant trait is transferred from variety B to an otherwise improved variety A

Comparison of Pedigree, Bulk and Backcross methods of breeding

<i>Particulars</i>	<i>Pedigree Method</i>	<i>Bulk Method</i>	<i>Backcross Method</i>
1. Application	Used in self and cross pollinated crops	Used in self-pollinated crops	Used in self and cross pollinated crops
2. Crossing	Done only once	Done only once	Done repeatedly with recurrent parent
3. Selection	Human selection plays important role	Both natural and human selections are involved	Human selection is involved
4. F_2 population to be evaluated	Smaller than bulk method	Larger than pedigree method	Smaller than both pedigree and bulk method
5. Maintenance of records	Pedigree records are maintained	Pedigree records are not maintained	Pedigree records are not maintained
6. Effectiveness	Equally effective with oligogenic and polygenic traits	Equally effective with oligogenic and polygenic traits	More effective with oligogenic traits such as disease resistance
7. Testing	Extensive testing is required before release of new variety	Extensive testing is required before release of new variety	Extensive testing is not required, because new variety differs from old variety in one trait only
8. Time taken	It takes 14-15 years to release new variety	It requires longer period than pedigree method	It takes 7-8 years for release of new variety
9. Breeding procedure	Same for dominant and recessive characters	Same for dominant and recessive characters	Differs for dominant and recessive characters
10. Adaptation	Variety released by this method has narrow adaptation	Variety released by this method has wide adaptation	Adaptation is like that of parent variety
11. Use	This method is widely used	Less popular	Widely used
12. Features of new variety	New variety is different from both the parents	New variety is different from both the parents	New variety is identical to recurrent parent except for the character transferred

Achievements

1. Two cotton varieties 170-Co-2 and 134 - Co 2m were developed
2. Kalyana sona susceptible to leaf rust. Resistant has been transferred from several diverse sources *i.e.*, Robin, K1, Blue bird, Tobari, Frecor and HS-19
3. Tift 23A is susceptible to downy mildew. The line backcrossed with MS-521A, MS-541A, MS-570A resistant hybrids were produced

Merits and Demerits of Back cross methods

Refers to

